SELF-EDUCATIONAL SERIES

No. 7

Gravitation ⁂ ⁂ What It Means

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THE law of universal gravitation, discovered by Isaac Newton when he was twenty-two years old, in 1666, is as follows:

Every particle of matter in the universe attracts every other particle with a force which is in the direction of a straight line joining the two, and whose magnitude is proportional to the product of the masses and inversely proportional to the distance between them.

This may be stated in slightly different language. Every portion of matter attracts every other portion of matter, and the stress between them is proportional to the product of their masses divided by the square of their distance.

The Facts of Gravitation.

Newton was led, as we may remember, to this supreme discovery by the contemplation of a falling apple; and gravitation is in the first place a terrestrial or earthly matter. It does not need a Newton to know that unsupported objects fall to the earth; and if they fall, it must be that some force has been impressed upon them; our study of the first law of motion has taught us that. It is plainly a great step from the assertion that the earth exerts an attractive force upon an apple to the assertion that the sun exerts an attractive force upon the earth, and to the further assertion that the apple attracts the earth, and the earth the sun.

For very many years the truth of the law of gravitation could not be asserted save of the earth, objects upon the earth, and the planets in their relation to the sun—that is to say, gravitation was a truth of the solar system, but we could positively say no more. The French philosopher, Auguste Comte declared that we should never be able to assert whether or not gravitation acts among the stars. He was wrong, for less than fifty years after his death we are able to say that the facts recorded in an enormous and constantly increasing number of observations do demonstrate the action of gravitation among the stars. We are therefore now justified in believing that it is an omnipresent force.

If Gravitation Were Abolished.

We know that the mass of a body is the stuff it contains, but that the weight of a body is merely the outward indication of the force of gravitation between the earth and the body in question. If gravitation were abolished it would require no effort whatever to lift by one finger a weight of a million pounds, but there would be as much stuff in the object lifted as before; its mass would be unaltered. Hence in the case of the planets and the stars, astronomers never think of talking of their weight; the term has no meaning, for gravitation is acting upon them in all directions. We can only conveniently talk of weight where, as in the case of a stone held in one's hand, gravitation is for practical purposes acting only in one direction—viz., downward. Thus by weight we mean the downward force of gravitation; but downward means nothing when applied to Sirius or Jupiter. Astronomers may therefore talk of the mass of the heavenly bodies and of their density, which is the relation of their mass to their size or volume, but never of their weight.

As we have seen, then, if gravitation were abolished we should all be strong men, and if its force were altered, as it would be by our transference to a smaller or larger planet, such as Mars or Jupiter, the possibilities of our lives would be very much modified; but it has nowhere been clearly enough stated that, according to the prevailing theory, we owe our very existence to gravitation!

Energy and Shrinkage of the Sun.

Every one knows that the earth owes its energy to the sun, the source of all our light and heat, without which life could never have been evolved upon the earth, and with the extinction of which it must necessarily cease. Now, according to the theory of the great German physicist, Hermann von Helmholtz, the sun obtains energy from its constant shrinkage, and this shrinkage is due to the mutual action of gravitation between the innumerable atoms of which the sun is composed. Quite recent research has shown that, in all probability, gravitation is not the sole source of the solar energy, but it is at the very least an important contributing source of the power in virtue of which human life is possible.

Here Is a Wonderful Thought.

Gravitation having given us life, and ever binding us to the sun—from the company of which the earth would soon separate herself in virtue of Newton's first law of motion but for the constraining power of gravitation—this great principle proceeds to supply man's mind with the most striking proof of what is perhaps its most lofty conception. This conception is that this great and various world of ours—flowers and stars, educators and elephants, men and meteors—is what we rightly but uncomprehendingly call a universe—that is to say, all are in reality one. It is Newton's law of gravitation that furnishes us with the most powerful support for this belief. The poet is actually right who says:

"Thou canst not stir a flower
Without troubling of a star."

If the law of gravitation be true, you cannot stir a flower, you cannot even cause movements of matter in your brain in the mere intention to stir a flower, without thereby altering the position, in accordance with universal gravitation, of all the matter in the universe. As the present writer has ventured to say elsewhere, every breath we draw affects the path of Sirius and the Pleiades.

The Marble and the Star.

The simplicity of the law of gravitation is so striking that it leads to a very interesting speculation as to the cause of gravitation. The cause underlying a law so simple must itself be very simple. The law states that not only every atom in the universe attracts every other, but that the force with which they do so bears the simplest possible relation to their mass and the distance between them. If the mass be added to, the force is added to in proportion. If the distance be doubled, the force is reduced to a fourth of what it was before. The law holds to a hair, however you alter the conditions as to distance or mass, or disparity of size between the two bodies we consider. It holds whether you deal with a couple of marbles on the table before you, or with the mighty star Sirius and that invisible dark companion of his which the law of gravitation has discovered for us, or with one of the marbles and Sirius. Plainly, therefore, the cause of phenomena so constant, so invariable, yet capable of such very simple expression, must itself be constant, invariable and simple.

The Value of Gravitation.

In the British Isles the value of "g" (symbol for the force of gravitation), as determined by the direct method, by pendulum experiment, and by other means, is about 32.2 feet per second per second. This phrase is somewhat confusing at first, the repetition of the phrase "per second" seems stupid, but in point of fact it is quite sensible. The assertion is that gravity produces during every second of its action an acceleration of 32.2 feet per second—that is to say, its force is equal to an acceleration of 32.2 feet per second. It need hardly be said that gravity does not act intermittently, but continuously; we use the period of a second merely for convenience. The value of "g" at the equator is less than 32.1; at the poles it is about 32.25. This is equivalent to saying that a body is heavier at the poles than at the equator.

Brainstorm Day.

By Walter A. Sinclair.

'Tis apish April First. Beware of all the old-time sort of snare.
Beware of all the traps that lurk. Look out as you hit off for work.
If griddle cakes are served, beware! Examine them with tender care.
For if with heedless haste you dined you found that they were flannel-lined.

Oh, Brainstorm Day, one month 'til May,
You go your old and foolish way.
For wisest men act foolish when
The year drifts round to Brainstorm Day.
We all grow bold. The chestnuts old
Are trotted out with laughter gay.
The pocketbook upon the hook
Doth tempting look on Brainstorm Day.

The subway guard just leaves us cool, slams shut the door, yells "April Fool!"
And as you rub your nose, see! see! the Ryan-Belmonts laugh in glee.
The "Pub-Utility" now trips as Long Pat pulls the rope and skips.
And Kelsey, safely off the rack, now pulls his resignation back.

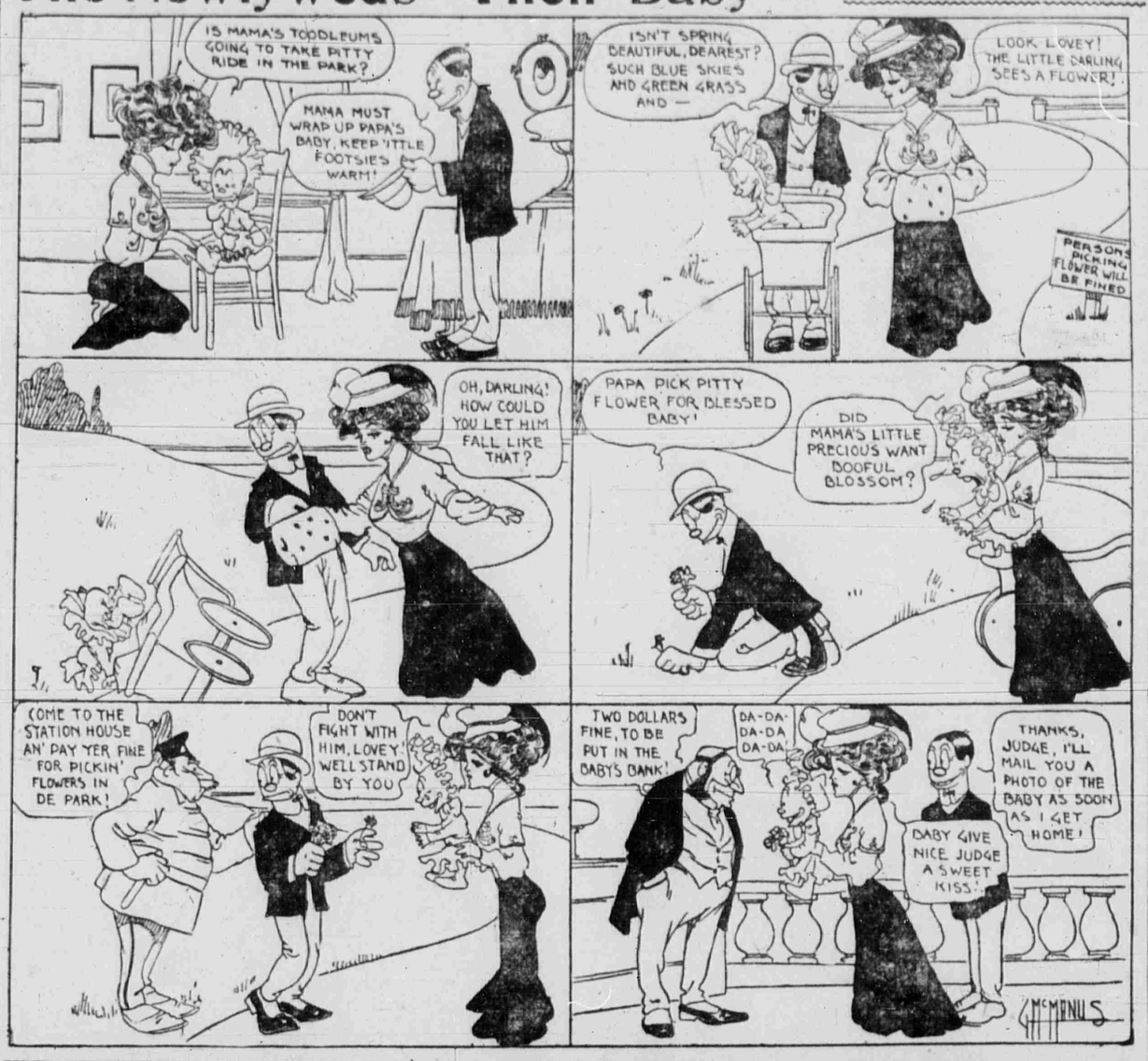
Oh, Brainstorm Day, they all obey
When April winds your fool tunes play,
And all will dance who have the chance
Though some the fiddler have to pay.
The same old game, the same old name,
"Call Mister Fish," you say.
"Aquarium's this place," then comes
Response on Brainstorm Day.

A Royal Fish Shooter.

THE King of Portugal, who is one of the most expert shots in Europe, exercises his skill in a remarkable way. Rifle in hand, he takes up a position by a lake in the palace grounds, and as the fish rise to the surface he fires at them, rarely missing.

The Newlyweds--Their Baby

By George McManus



BETTY ♡ VINCENT'S ♡ ADVICE ♡ TO LOVERS ♡

BOY AND GIRL FRIENDSHIPS.

SOMETIMES I am tempted to make a rule not to answer letters of men less than twenty-one years old or girls under eighteen. I have very little patience with sixteen-year-old love affairs. Boys and girls of that age should study and work and exercise and try to make fine men and women of themselves mentally and physically. Boy and girl friendships are natural and proper. Often, I know, it is the foolish winking and smirking of older people that turns a frank, honest childhood intimacy into a sickly, spindling, premature romance. Nearly always these romances are started by girls. Boys are naturally shy and the sentimental side of their nature develops slowly. If left to themselves they would not develop calf love very often, or at least not very desperately.

Schoolgirls, have as many boy friends as you like, but don't encourage them to make love to you, just because you have read too many novels. You may spoil some later, deeper, truer, real romance for yourselves if you do.

Marriage on $90 a Month.

Dear Betty:

I AM a young man about to be married, with a salary of $90 per month, and am a bit perplexed about the method of expending my income after marriage. I have arranged for the purchase of a suburban cottage, which I am able to furnish, and with the cash down payment made the monthly payments are to be $30, including interest, taxes, etc. Now, with house payments of, monthly, $30, life insurance $5, and water, gas, etc., $5, and my office car fare and meals $10, makes $50 in all.

I don't intend that my wife shall endure the humiliation of having to ask for money for her ordinary needs, so this is where I am perplexed. Would an allowance of $25 per month out of which she would pay the grocery and kitchen needs, and use the rest for her pin money be a fair sum? This would leave $15 per month from which clothing and the rainy day monthly deposit in bank would be made.

PERPLEXED.

I think the household allowance rather small. She may be able to manage with it, but $30 would be nearer right.

Shall She Dance with Others?

Dear Betty:

I AM a young girl seventeen years old, and am going with a young man one year my senior. I expect to go to a reception soon and will meet many other friends. Now, if any of them should ask me to dance with him should I ask my friend's permission, as he has treated me very kindly and I should not like to hurt his feelings?

ANXIOUS.

If you are engaged to the young man consult his wishes. Never ask a man for "permission." Unless you are engaged do not ask him.

He Is Not Popular.

Dear Betty:

I AM a young man twenty-one years of age, with a good education, limited in my means to my salary, which amounts to $25 per week. I have very little acquaintance with the girls, and they do not seem to care for me. I am not a Beau Brummel, but have a good appearance, dress neatly and am not in any way backward; in fact, a great many of my friends say I am too showy, talk too much, although they admit I am witty and good company. I am very lonesome and am anxious to get acquainted with some respectable girls, which would eventually lead to matrimony. Can you think of any reason why the girls do not take to me, like other fellows, and what would you do if in my position?

L.

Possibly you are too assured. Try to think less of yourself and more of other people.

He Seeks A Secret Marriage.

Dear Betty:

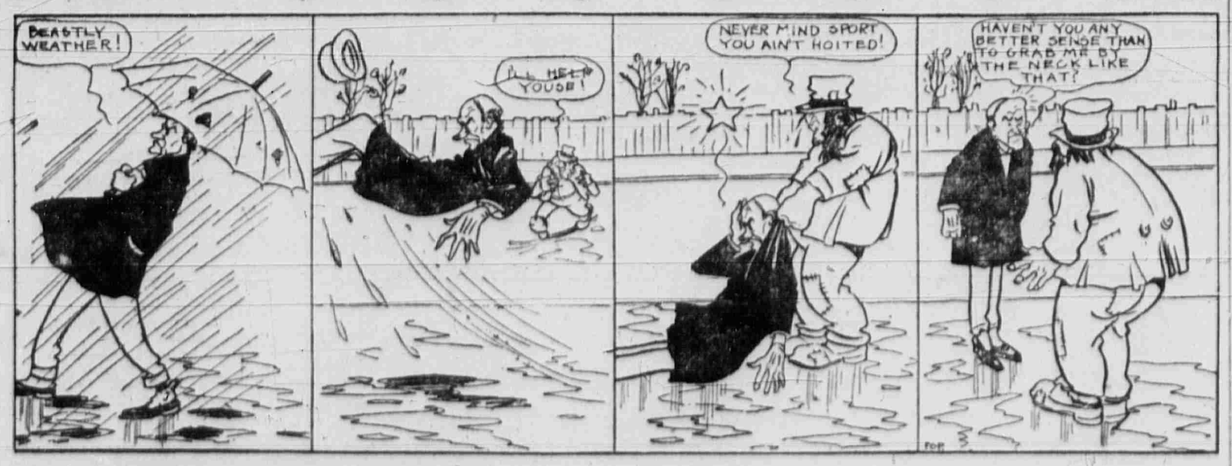
I AM a young man twenty years old and would like to get married on the quiet, but am in the dark about what to do as to questions and so forth, and if you must have some one to stand up for you. My fiancee is nineteen. Is the age all right?

K. C.

Secret marriages are very unwise, and you are too young to realize the seriousness of the step you contemplate. All marriages require two witnesses. The girl is old enough legally, but I strongly advise you to wait till you are in a position to marry her openly.

Grouch!

By Pop.



HEALTH AND BEAUTY.

By Margaret Hubbard Ayer.

Rough Hands.

C.—Your brittle fingernails are probably due to the same cause as the rough red hands. In doing housework, try and avoid as much as possible dipping your hands into strong soapsuds and diluted scrubbing mixtures. Wear rubber gloves. Use mops and scrubbing brushes with handles, anything but your hands. To keep them soft, after they have been thoroughly cleansed with a pure bland soap and warm water or with almond meal, rinse them, and while still wet rub in a little glycerine or cold cream. Here is a formula for curing the brittle nails: White vaseline, 1 ounce; powderized white castile soap, 60 grains; oil of rose, sufficient to perfume.

To "Cover" Freckles.

J. T.—It would be very difficult to cover freckles unless you were going to use a regular make-up, and you had much better bleach them off. The cream for which I give you a formula can be applied to the face before going out. Rub the cream well into the skin and then wipe off with a soft cloth, and dust the face over with powder: Sweet almond oil, four ounces; white wax (melted), 250 grains; spermaceti, 330 grains; benzoin (finely powdered), 192 grains; tincture of ambergris, sixty grains; rice powder, 32 grains; pure carmine, fifteen grains. Blend the fats in a custard boiler, as previously directed for all creams; add the benzoin while they are heating; the rice and carmine while cooling, and tincture last of all. Spread it on the face and throat, gently and carefully, rubbing it into the skin, and avoid its getting into the eyebrows or close to the eyes. Powder with any fine flesh-colored powder or velouting, applying freely with a puff, and after a little while wipe off with a bit of chamois.

HINTS FOR THE HOME.

Gingerbread.

MELT one tablespoon of butter in a saucepan, add one-half cup molasses, when it comes to boiling point remove from stove and quickly add one teaspoon soda, stirring briskly. Add one-half cup sugar, one egg, one cup sour milk, one and one-half teaspoons of ginger, one and one-half cups of flour and pinch of salt. Bake in nine-inch square tin for twenty-five minutes. Always use measuring cup and pastry flour for cakes. Sprinkle top with powdered sugar.

Prune Batter.

SOAK 1 pint of prunes overnight, drain and remove the stones. In your wooden bowl chop 2 ounces of beef suet very fine, add 4 ounces of sugar (half a cupful, the same of flour, 1 egg, a saltspoon of ground cinnamon, 1-2 saltspoon of grated nutmeg. Mix this thoroughly with a wooden spoon for five minutes, then beat in 4 tablespoons of thick cream and 2 ounces of bread crumbs (2 heaping tablespoons), mix thoroughly and then add the prune pulp lightly. Butter and flour your pudding bag or a stout cloth, and drawing up the four corners of the latter, tie them tightly. Drop into a pot of boiling water twice and a half the depth of the pudding, and boil 2 1-2 hours. Then hang it up to drain about ten minutes, suspending from a hook over a dish. Untie, turn out on a deep dish, dredge over with powdered sugar and serve with hard or foamy sauce, flavored with lemon.

Johnny Cake.

ONE pint buttermilk, half teaspoon soda, 1 teaspoon salt, 2 tablespoons butter, half cup sugar, 1 cup flour in which 1 teaspoon baking powder has been sifted. Use granulated cornmeal to make a batter about like a layer cake. Bake in a drinking pan. Use above recipe for buckwheat cakes, only use wheat instead of meal. It won't take so much, as buckwheat is very dry and swells more.

A NEW YORK MONTE CRISTO

Brewster's ⁂ ⁂ Millions

By Geo. B. McCutcheon.

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SYNOPSIS OF PRECEDING CHAPTERS.

Montgomery Brewster, a young New York bank clerk, inherits $1,000,000 from his grandfather. As he is about to settle down to the enjoyment of his legacy he is notified that his uncle in Montana has just died, leaving him $7,000,000. But by the terms of the uncle's will Brewster must within one year spend the $1,000,000 left him by his grandfather and become penniless, before he can inherit the $7,000,000. Swearingen Jones, of Montana, his uncle's executor, notifies him that this money must be spent rationally. Brewster at once begins his task of squandering a million dollars in a single year. His friends despise him as a mere spendthrift. He is forbidden by the terms of the will to explain his reasons for squandering the millions. Extravagant entertainments, capped by a far more wildly lavish yacht cruise, wipe out practically all of his fortune within the allotted time. He has meantime fallen in love with Peggy Gray, a companion of his childhood, and his love is reciprocated. Peggy's mother is a gentlewoman in reduced circumstances with whom Brewster formerly boarded.

CHAPTER XXV.

The Promise of Thrift.

"MONTY, you are breaking my heart," was the first and only appeal Mrs. Gray ever made to him. It was two days before the twenty-third, and it did not come until after the "second-hand store" men had driven away from her door with the bulk of his clothing in their wagon. She and Peggy had seen little of Brewster, and his nervous restlessness alarmed them.

His return was the talk of the town. Men tried to shun him, but he persistently wasted some portion of his fortune on his unwilling subjects. When he gave $5,000 in cash to a Home for Newsboys, even his friends jumped to the conclusion that he was mad.

Mrs. Gray met him in the hallway of her home as he was nervously pocketing the $60 he had received in payment for his clothes. Her face was like that of a ghost. He tried to answer her reproof, but the words would not come, and he fled to his room, locking the door after him. He was at work there on the transaction that was to record the total disappearance of Edwin Brewster's million—his final report to Swearengen Jones, executor of James Sedgwick's will. On the floor were bundles of packages, carefully wrapped and tied, and on the table was the long sheet of white paper on which the report was being drawn. The packages contained receipts—thousands upon thousands of them—for the dollars he had spent in less than a year. They were there for the inspection of Swearengen Jones, faithfully and honorably kept—as if the old Westerner would go over in detail the countless documents.

He had the accounts balanced up to the hour. On the long sheet lay the record of his ruthlessness, the epitaph of a million. In his pocket was exactly $79.08. This was to last him for less than forty-eight hours, and—then it would go to join the rest. It was his plan to visit Grant & Ripley on the afternoon of the 22d and to read the report to them, in anticipation of the meeting with Jones on the day following.

Just before noon, after his encounter with Mrs. Gray he came downstairs and boldly, for the first time in days, sought out Peggy. There was the old smile in his eyes and the old heartiness in his voice when he came upon her in the library.

"Peggy, do you think I'm worth anything more from your mother? Do you think she will ask me to live here any longer?" he asked, steadily, taking her hand in his. Hers was cold, his as hot as fire. "You know what you said away off yonder somewhere, that she'd let me live here if I deserved it. I am a pauper, Peggy, and I'm afraid I'll—I may have to get down to drudgery again. Will she turn me out? You know I must have somewhere to live. Shall it be the poorhouse? Do you remember saying one day that I'd end in the poorhouse?"

She was looking into his eyes, dreading what might be seen in them. But there was no gleam of insanity there, there was no fever; instead there was the quiet smile of the man who is satisfied with himself and the world. His voice bore traces of emotion, but it was the voice of one who has perfect control of his wits.

"'Tis all—gone, Monty?" she asked, almost in a whisper.

"Here is the residue of my estate," he said, opening his purse with steady fingers. "I'm back to where I left off a year ago. The million is gone and my wings are clipped." Her face was white, her heart was in the clutch of ice. How could he be so calm about it when for him she was suffering such agony? Twice she started to speak, but her voice failed her. She turned slowly and walked to the window, keeping her back to the man who smiled so sadly and yet so heartlessly.

"I didn't want the million, Peggy," he went on. "You think as the rest do, I know, that I was a fool to act as I did. It would be rank idiocy on my part to blame you any more than the others for thinking as you do. Appearances are against me, the proof is overwhelming. A year ago I was called a man, to-day they are stripping me of every claim to that distinction. The world says I am a fool, a dolt, almost a criminal—but no one believes I am a man. Peggy, will you feel better toward me if I tell you that I am going to begin life all over again? It will be a new Monty Brewster that starts out again in a few days, or, if you will, it shall be the old one—the Monty you once knew."

"The old Monty?" she murmured softly, dreamily. "It would be good to see him—so much better than to see the Monty of the last year."

"And, in spite of all I have done, Peggy, you will stand by me? You won't desert me like the rest? You'll be the same Peggy of the other days?" he cried, his calmness breaking down.

"How can you ask? Why should you doubt me?"

For a moment they stood silent, each looking into the heart of the other, each seeing the beginning of a new day.

"Child"—his voice trembled dangerously—"I—I wonder if you care enough for me to—to"— but he could only look the question.

"To start all over again with you?" she whispered.

"Yes—to trust yourself to the prodigal who has returned. Without you, child, all the rest would be as the husks. Peggy, I want you—you! You do love me—I can see it in your eyes, I can feel it in your presence."

"How long you have been in realizing it," she said pensively, as she stretched out her arms to him. For many minutes he held her close, finding a beautiful peace in the world again.

"How long have you really cared?" he asked, in a whisper.

"Always, Monty; all my life."

"And I, too, child, all my life. I know it now; I've known it for months. Oh, what a fool I was to have wasted all this love of yours and all this love of mine. But I'll not be a profligate in love, Peggy. I'll not squander an atom of it, dear, not as long as I live."

"And we will build a greater love, Monty, as we build the new life together. We never can be poor while we have love as a treasure."

"You won't mind being poor with me?" he asked.

"I can't be poor with you," she said simply.

"And I might have let all this escape me," he cried fervently. "Listen, Peggy—we will start together, you as my wife and my fortune. You shall be all that is left to me of the past. Will you marry me the day after to-morrow? Don't say no, dearest. I want to begin on that day. At seven in the morning, dear? Don't you see how good the start will be?"

And he pleaded so ardently and so earnestly that he won his point, even though it grew out of a whim that she could not then understand. She was not to learn until afterward his object in having the marriage take place on the morning of Sept. 23, two hours before the time set for the turning over of the Sedgwick millions. If all went well they would be Brewster's millions before 12 o'clock, and Peggy's life of poverty would cover no more than three hours of time. She believed him worth a lifetime of poverty. So they would start the new life with but one possession—love.

Peggy rebelled against his desire to spend the $70 that still remained, but he was firm in his determination. They would dine and drive together and see all of the old life that was left—on $70. Then on the next day they would start all over again. There was one rude moment of dismay when it occurred to him that Peggy might be considered an "asset" if she became his wife before 9 o'clock. But he realized at once that it was only demanded of him that he be penniless and that he possess no object that had been acquired through the medium of Edwin Peter Brewster's money. Surely this wife who was not to come to him until his last dollar was gone could not be the product of an old man's legacy. But so careful was he in regard to the transaction that he decided to borrow money of Joe Bragdon to buy the license and to pay the minister's fee. Not only would he be penniless on the day of settlement, but he would be in debt. So changed was the color of the world to him now that even the failure to win Sedgwick's millions could not crush out the new life and the new joy that had come to him with the winning of Peggy Gray.

(To Be Continued.)

May Manton's Daily Fashions.

Fancy Yoke Blouse—Pattern No. 5625.

THE waist that is full and soft suits a great many figures better than any other sort and here is a very charming one that is made with a becoming yoke and quite novel sleeves. The original from which the drawing was made makes part of an entire gown, the material for which is crepe de Chine, while the trimming is ruchings of the material and the little flat braid applied over a waved outline. The material being soft and pliable, lends itself to the trimming with perfect success, but there are so many others of which this special fact also is true that the list of available ones is long and comprehensive. For immediate wear the thinner silks and wools are charming, but later the pretty cotton voiles and silk and cotton stuffs can be used with perfect propriety. Again, trimming can be varied in a number of ways. The ruchings are pretty and effective, but are not obligatory, as banding could be substituted, or almost anything that might be preferred, while the braid could be of any sort and applied in any way.

The quantity of material required for the medium size is 4 1-4 yards 21, 4 yards 27 or 2 1-4 yards 44 inches wide, with 5 yards of puffing.

Pattern 5625 is cut in sizes for a 32, 34, 36, 38 and 40-inch bust measure.

How to Obtain These Patterns

Call or send by mail to THE EVENING WORLD MAY MANTON FASHION BUREAU, No. 2 West Twenty-third street, New York. Send ten cents in coin or stamps for each pattern ordered.

IMPORTANT—Write your name and address plainly, and always specify size wanted.